Center Independent Research & Development: GSFC IRAD

Microwave Readout to Enable the Imaging Spectrometer for the X-ray Surveyor

Completed Technology Project (2016 - 2017)

Project Introduction

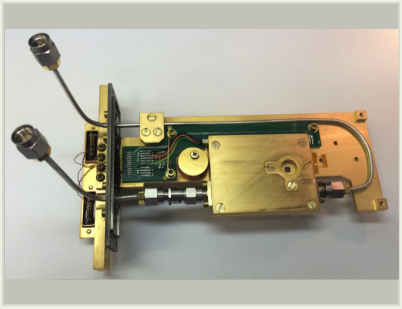
The X-ray Surveyor mission concept is one of NASA's four large missions to be studied in the upcoming 2020 Astrophysics Decadal Review. It aims to be a true follow-on to the Chandra X-ray Observatory, retaining the exquisite < 1 arcsec angular resolution in the soft x-ray band (0.3–12 keV) but with a much larger collecting area and improved instrumentation, including a non-dispersive imaging spectrometer. This combination will enable observations essential to understanding the earliest galaxies and supermassive black holes, as well as galaxy formation and the assembly of large-scale structure from the earliest epochs.

Microcalorimeters are non-dispersive devices that have achieved excellent energy resolution, providing resolving powers of >3000 at 6 keV. They are the leading detector technology for high-resolution x-ray imaging spectrometers, and the X-ray Surveyor as currently envisaged includes a microcalorimeter instrument. But, the surveyor instrument will require a hundred times the number of pixels compared to our state-of-the-art microcalorimeter arrays: a hundred thousand pixels are needed to match the spatial resolution of the X-ray Surveyor optic while covering 5'x 5'.

This project aims to increase the technical readiness of the readout technology that is suitable for these large microcalorimeter arrays. In collaboration with colleagues at NIST, Boulder, we will perform readout demonstrations of transition-edge-sensor microcalorimeters using microwave SQUID multiplexer chips and newly acquired room-temperature readout electronics.

Anticipated Benefits

Increase the TRL of detector and readout technology to enable next generation x-ray astrophysics missions.



Low-temperature setup for testing x-ray micro calorimeter array using microwave readout.

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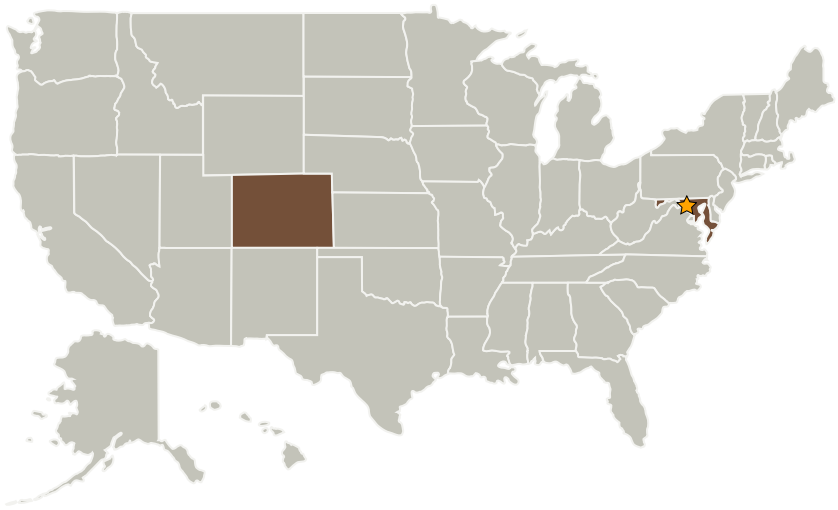
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Co-Funding Partners	Type	Location
National Institute of Standards and Technology(NIST)	US Government	Boulder, Colorado

Primary U.S. Work Locations	
Colorado	Maryland

Project Transitions

October 2016: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Megan E Eckart
Timothy D Beach

Principal Investigator:

Megan E Eckart

Co-Investigators:

Simon R Bandler
Kazuhiro Sakai
Wonsik Yoon

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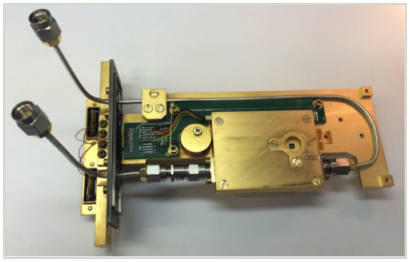
September 2017: Closed out

Closeout Summary: The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services.Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry.The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies.If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. http://techport.nasa.gov/help

Images



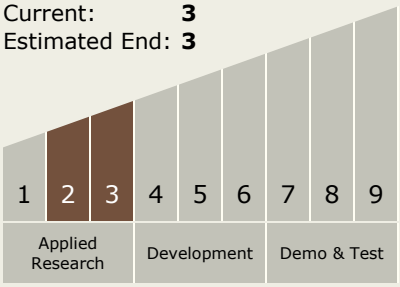
Low-temperature setup for testing x-ray micro calorimeter array using microwave readout.
Low-temperature setup for testing x-ray micro calorimeter array using microwave readout.
(https://techport.nasa.gov/image/26032)

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Outside the Solar System, Foundational Knowledge